

Advancing Torpor Inducing Transfer Habitats for Human Stasis to Mars

Completed Technology Project (2016 - 2018)



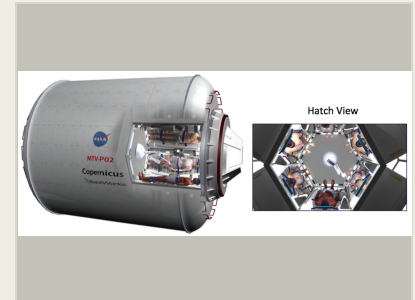
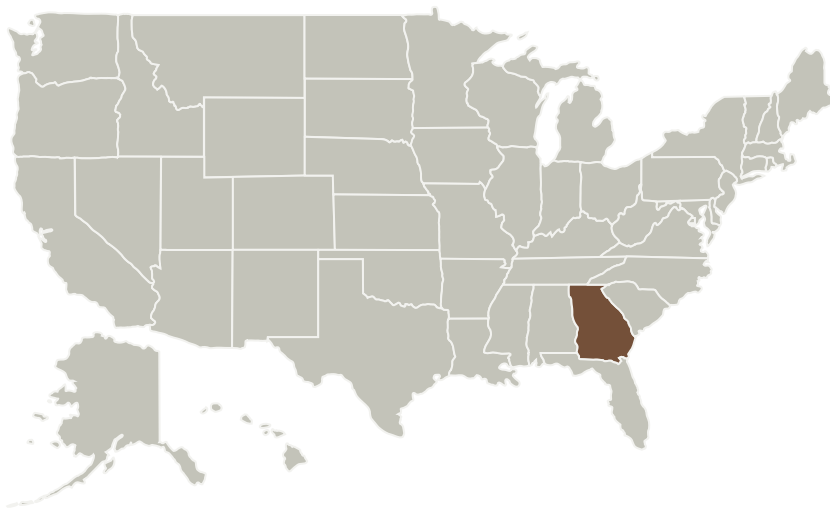
Project Introduction

SpaceWorks proposes the development of an advanced habitat system for transporting crews between the Earth and Mars. This new and innovative habitat design is capable of cycling the crew through inactive, non-cryonic torpor sleep states for the duration of the inspace mission segments. Under this effort, SpaceWorks will (i) Expand the Phase I medical team to address key challenges identified in the initial effort, (ii) Examine key habitat engineering aspects to further explore and refine design and identify further potential performance gains, (iii) Initiate prolonged hypothermia animal testing and evaluations through a leading medical research center, and (iv) Consider the technology's impact on alternate exploration missions (Mars moons, asteroid belt, Jovian and Saturn system, etc.).

Anticipated Benefits

SpaceWorks proposes the development of an advanced habitat system for transporting crews between the Earth and Mars. This new and innovative habitat design is capable of cycling the crew through inactive, non-cryonic torpor sleep states for the duration of the inspace mission segments.

Primary U.S. Work Locations and Key Partners



SpaceWorks' Vision System Torpor Habitat Design. Credits: J. Bradford

Table of Contents

Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Images	3
Links	3
Technology Areas	3
Target Destination	3

Organizations Performing Work	Role	Type	Location
SpaceWorks Enterprises, Inc.(SEI)	Lead Organization	Industry	Atlanta, Georgia

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Primary U.S. Work Locations

Georgia

Project Transitions

**July 2016:** Project Start**June 2018:** Closed out

Closeout Summary: SpaceWorks Enterprises, Inc. (SEI) has conducted an evaluation of an advanced habitat system designed to transport crews between the Earth and Mars. This new and innovative habitat concept is capable of placing crew members in inactive, torpor states during transit phases of a deep space mission. This substantially reduces the mass and size of the habitat, which ultimately leads to significant reductions in the overall architecture size. Our approach for achieving this is based on extending the current and evolving medical practice of Therapeutic Hypothermia (TH) - a proven and effective treatment for various traumatic injuries. TH is a medical treatment that lowers a patient's body temperature by just 5 to 10 degrees Fahrenheit causing human metabolic rate to decrease significantly and the body to enter an unconscious state. This method avoids the intractable challenges often associated with cell metabolic cessation through cryogenic freezing and other highly speculative approaches. The initial results obtained from the research and analysis conducted in the Phase I effort warranted further study of this concept and technology. The specific objectives of the continued work include: 1. Addressing critical medical aspects and risks for inducing torpor via Therapeutic Hypothermia and the approach for providing nutrition and hydration for the crew during torpor 2. Focusing on mitigation aspects and technology potential for solving key human spaceflight challenges 3. Addressing critical engineering aspects of the design that may impact the initial performance and cost results obtained in Phase I 4. Examining the broader extensibility and enabling capabilities of this concept through applicability to additional exploration missions beyond Mars 5. Establishing a technology development roadmap, addressing both medical and engineering aspects, that indicate a logical and scientifically achievable path forward for maturation of this technology For this effort, four (4) key task areas were identified. These were structured and developed based on prior work to address key challenges/issues and to achieve the research objectives. Each element was designed to further explore and advance our knowledge of the concept. As shown in Figure 1, the focus areas and study task activities are: (i) Medical Assessments and Evaluations (ii) Mars Mission Habitat Design (iii) Extensibility Beyond Mars (iv) Technology Roadmap Development

Closeout Link: <https://www.nasa.gov/feature/advancing-torpor-inducing-transfer-habitats-for-human-stasis-to-mars>

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

SpaceWorks Enterprises, Inc. (SEI)

Responsible Program:

NASA Innovative Advanced Concepts

Project Management

Program Director:

Jason E Derleth

Program Manager:

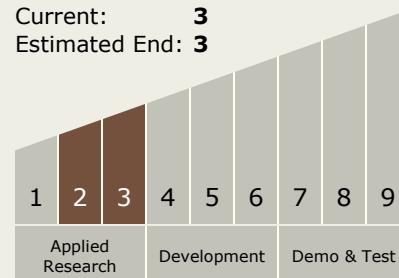
Eric A Eberly

Principal Investigator:

John E Bradford

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**

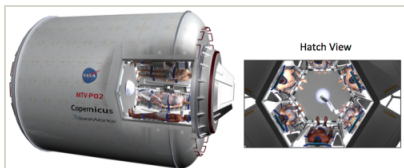


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Images



Project Image

SpaceWorks' Vision System Torpor Habitat Design. Credits: J. Bradford (<https://techport.nasa.gov/image/102059>)

Links

NASA.gov Feature Article
(<https://www.nasa.gov/feature/advancing-torpor-inducing-transfer-habitats-for-human-stasis-to-mars>)

Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
 - └ TX06.3 Human Health and Performance
 - └ TX06.3.1 Medical Diagnosis and Prognosis

Target Destination

Mars